The injury in the great majority of cases when it is in the anterior segment of the eye is not attended with a prolapse of the iris, and the occurrence of this complication makes it probable that the foreign body has not penetrated the globe. This symptom is not a reliable one in case the foreign body has made a large or irregular wound in the eye.

If the foreign body has penetrated into the vitreous or posterior part of the globe, localization either with the sideroscope or *x*-ray had better precede any attempt to extract it, especially if the lens is still transparent. After the particle has been localized it can be removed by way of the anterior chamber with the Haab magnet, or by opening directly into the sclera near where the particle has been located.

If the symptom of pain cannot be elicited with the Haab magnet this is to be interpreted as evidence that there is no foreign body in the eye; that it is enveloped, in recent cases, in a fibropurulent exudation, or a blood clot, or (in less recent cases) that it is firmly encapsulated, that it has passed entirely through the globe, and is lodged partly or wholly in the orbital tissues (double perforation).

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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The Chemical Constitution of Bacterial Cells and the Mode of Formation of Antitoxins.—The chemical constitution of bacterial cells and the mode of formation of antitoxins in the body are subjects which to-day are commanding an enormous amount of scientific investigation. No contribution to the solution of the question of chemical composition has appeared which is more worthy of note than that of Professor V. C. VAUGHAN (*Journal of the American Medical Association*, September 3, 1904, p. 643). Various of his students have shown the presence of carbohydrates, nuclein bodies, proteids, and poisons in the cell substance of a number of species of bacteria, and lately he and Wheeler have succeeded in splitting off, by means of sodium alcoholate, highly poisonous groups from the cell substance of the colon, typhoid and anthrax bacilli, and with these groups they have produced neutralizing antibodies. Investigation of the colon toxin leads Vaughan to the conclusion that it is composed of a haptophore and a toxophore group, and he suspects that the toxin group is a neurin, the reasons being both chemical and physiological. The part of the colon cell substance which is soluble in water is non-poisonous, but it yields a hæmolysin and a group that splits up the hæmoglobin into hæmatin and a globulin. The split-off toxin, thrown into the peritoneal cavity of a guinea-pig, causes death, with no evidence of irritation of the peritoneum, within very few minutes; but when the sterile germ substance is introduced, the result is a hemorrhagic peritonitis, ending in death in from ten to twenty-four hours. Vaughan believes that the colon bacillus is a definite chemical compound, in whose molecule has been demonstrated the existence of the following groups: nuclein, amido, diamido, monoamido, carbohydrate, toxic, hæmolytic, and hæmoglobin-splitting. Probably many other groups and subgroups also are present; and in all the groups are attached to one another, forming a highly complex molecule, which splits up on lines dependent upon the kind and amount of energy applied. Since the force which holds the several groups in the molecule varies in strength, some groups are split off more easily than others. The cells of the body are doubtless equally complicated in their chemical constitution, and Vaughan believes that the reaction between a bacterium and a body cell is as definitely chemical as that between sulphuric acid and calcium carbonate. If the chemism between a group of the one and a group of the other is greater than that which holds these groups in their respective molecules, a reaction takes place, the two groups form a new molecule, and the injury done to the bacillus or the cell depends upon the group that has been abstracted. Without such reaction, no body cell can be harmed by a bacillus molecule, but when such a reaction is possible it occurs much more rapidly if the group which forms the union is injected after being split off, rather than as a constituent part of the complex molecule. This is the reason why the toxin and the sterile cell substance produce their results after such differing intervals, the colon molecule requiring splitting up before the toxic group can become active. Still more rapid is the action when the free toxin is injected intravenously and thus reaches the cells of the respiratory centre more directly. Assuming this reaction between bacillus and cell to be true, the formation of antitoxins can be explained; and Vaughan offers an exceedingly simple, sensible, and reasonable explanation, which, briefly, is as follows: If the chemical attraction between the toxin group and a given group in the cell is stronger than that which holds these groups in their molecules, they unite and form a saturated, stable, new molecule which is not harmful. The cell is injured, but not destroyed, and it proceeds to repair itself by splitting off from the nutritive substances within the range of its chemism groups similar to that which it has lost; but splitting off more than it needs, the excess becomes the antitoxin of the blood serum. With the toxin in question, the fatal results are explained as follows: The toxin group has a special chemical affinity for the cells of the respiratory centre, which are not destroyed by the toxin, but a certain number of them are thrown out of commission, and if the number be great enough respiration ceases and the animal dies. This paper of Dr. Vaughan's is a very important and illuminating contribution to the literature of an exceedingly complicated subject, and his hypothesis of antitoxin formation appears to have a more substantial scientific basis than any other thus far advanced.

Transmission of Tuberculosis through Flies.—Noticing the number of flies that flock about the cuspidors of phthisical patients, DR. E. H. HAYWARD (*New York and Philadelphia Medical Journal*, October 1, 1904, p. 643) undertook a series of experiments with the common house fly and the blue-bottle fly to determine whether or not they may be an etiological factor in tuberculosis. Sputum in which the bacilli were known to be present was put into watch-glasses and covered with fine wire screens, on which the flies could rest and feed through the meshes without soiling their feet and wings. Six hours afterward clean cover-glasses were introduced, and during the next three or four hours these became soiled with the flies' excrement. Examination showed tubercle bacilli on each one. That the vitality of the bacilli was not impaired was proved by making cultures of the feces on glycerin agar and obtaining growths of the organism, and also by injection of the feces, rubbed up with sterile water, into the peritoneal cavity of guinea-pigs, which developed tuberculosis. The author points out that through the agency of flies the bacilli may be carried from the sputum of one person and deposited upon the food of another, so that the passage from one person's lungs to another's alimentary canal may be accomplished within a few hours.

The Copper Sulphate Treatment of Water.—During the few months that have elapsed since the publication of the results of experiments conducted by MOORE and KELLERMAN (*United States Department of Agriculture, Bureau of Plant Industry, Bulletin* 64), on the use of extremely dilute solutions of copper sulphate as an algacide in reservoirs and ponds overgrown with algæ and for destroying typhoid and cholera infection, many practical applications of the method have been made in various parts of the country, with results varying from complete success (against algæ) to utter failure. The authors gave warning, however, that each body of water should be studied separately as a distinct problem, and invited consultation in every case of intention to attempt treatment. Objection has been made in various quarters to the use of even so minute an amount as one part of copper sulphate in 5,000,000 of water, on account of possible ill-effects therefrom, although the daily ingestion of small amounts of that salt is held, rightly or wrongly, by most authorities to be free from danger to health. But it is asserted that within a very short time all traces of copper disappear from the solution. However this may be with some waters, it is not true with all, for it is the experience of the present writer and of probably many others that evidence of its presence may still be found some weeks after the treatment. It is said that the authorities of Elmira, N. Y., added not 1 part in 5,000,000, but 1 in 700,000, or about seven times as much, and that a litre of the water, taken thirty hours after treatment and concentrated by evaporation to a single cubic centimetre, yielded not the slightest trace of copper, it having been precipitated after performing its office. In this instance, it may be noted, there occurred complete destruction of the algæ and a diminution of more than 90 per cent. in the number of bacteria. In some cases, objection has been raised that, although the algæ are destroyed, the turbidity persists; but generally the killing of the algæ is followed by their rapid disintegration, with disappearance of turbidity. In other cases a more serious objection is that while certain species are destroyed far more easily than others, and although overgrowth by these may prevent the latter from undergoing extensive multiplication, the disappearance of the easily-destroyed species may remove the obstacles to and be followed by an overgrowth of an equally objectionable but more hardy species. With regard to the bactericidal power of colloidal solutions of copper, there are already many remonstrances that the original statements appear not to be justified. Among those who report against placing any reliance upon this form of treatment of public water supplies for the destruction of typhoid infection is

Professor John H. Long, of Northwestern University, who made an investigation of the subject in behalf of the Illinois State Board of Health. In a communication from Dr. J. A. Egan, the secretary of that board (*Journal of the American Medical Association*, October 15, 1904, p. 1157), Professor Long is quoted as saying: "While in sterilized water in contact with copper the death rate of typhoid bacilli is high, their persistence for two or three days, and the possible persistence for longer periods in larger amounts of water, render the method impracticable for use in rendering a suspicious water safe for household use." Attention is called to the fact that typhoid bacilli disappear from ordinary water in from one to ten days without treatment, and that, therefore, "the disappearance of the bacilli forty-eight hours after seeding in a copper vessel may be due not only to the action of the copper, but to the natural destruction of the bacilli in water."

Pus and Bacteria in Milk.—In 1900 it was pointed out by DR. D. H. BERGEY that a high cellular and bacterial content of milk appears to be associated with some inflammatory process within the udder. Since then DR. BERGEY (*University of Pennsylvania Medical Bulletin*, July-August, 1904) has studied the milk of several cows during an entire period of lactation, in order to obtain information concerning the relation of the period of lactation to the cellular and bacterial content. The milk of one of the cows selected for observation showed, previous to the preceding period of lactation, a slight amount of pus in association with staphylococci. That of Cow No. 2, examined for the first time after calving, showed no pus, but merely the normal leukocytic content, which is equivalent to the presence of not more than ten cells per field of a one-twelfth immersion lens. Cow No. 3 was suffering with contagious mammitis, and her milk after calving showed large amounts of yellow pus and very large numbers of streptococci. The milk of all three of these cows was examined at intervals of one or two months, until the close of the period of lactation, a period of nine months. The results of the investigation led to the following conclusions: 1. The occurrence of pus in cows' milk is probably always associated with the presence in the udder of some inflammatory reaction brought about by the presence of some of the ordinary pyogenic bacteria, especially of streptococci. 2. When a cow's udder has once become infected with the pyogenic bacteria, the disease tends to persist for a long time, probably extending over several periods of lactation. 3. Lactation has no causative influence *per se* upon the cellular and bacterial content of cows' milk, although it probably tends toward the aggravation of the disease when the udder is once infected. 4. Contagious mammitis, the "gelbe galt" of European writers, appears to be merely a severe form of mammitis due to a variety of streptococci, which, on accout of its chromogenic properties, gives to the milk its peculiar golden-yellow color.

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